

REMARKS

Reconsideration of the application in light of the following remarks is respectfully requested.

Status of the Claims

Claims 6 - 10 and 18 - 35 are currently pending in the present application. Applicants cancel claim 6 without prejudice or disclaimer, and amend claims 7, 9, 10, 18 - 24 and 27. No new matter is introduced.

Objected Claims

Claims 25, 26 and 28 - 35 are objected to under 37 C.F. R. § 1.75(c) as being multiple dependent claims improperly depending from multiple dependent claims. Applicants respectfully disagree. Each of claims 25, 26 and 28 - 35 is either singly and directly dependent on one of multiple dependent claims 23, 24 and 27, or is indirectly dependent on one of these claims through one of intervening claims 25, 26 and 28, which are each singly dependent on one of claims 23 and 24. Thus, none of claims 25, 26 and 28 - 35 constitute multiple dependent claims that depends from other multiple dependent claims in contradiction to the requirements of 37 C.F. R. § 1.75(c). Applicants therefore respectfully request that this rejection be withdrawn.

Rejection under 35 U.S.C. § 112

Claims 18 - 21 are rejected under the second paragraph of 35 U.S.C. § 112 as being indefinite. In particular, the Examiner finds that the claimed properties of the carbon film refer to the entire film or to just the amorphous carbon layer. Applicants amend claims 18 - 21 to specify that the claimed properties refer to the amorphous carbon layer. Applicants therefore submit that amended claims 18 - 21 are definite, and respectfully request that the rejection of claims 18 - 21 under the second paragraph of 35 U.S.C. § 112 be withdrawn.

Rejection under 35 U.S.C. § 102

Claims 6 - 10, 18 - 24 and 27 are rejected under 35 U.S.C. §102(e) as being anticipated by European Patent Publication No. EP 1 266 879 to Sumitomo Electric (“Sumitomo”). Claims 6 - 10, 18 - 24 and 27 are further rejected under 35 U.S.C. §10b(b) as being anticipated by any of U.S. Patent No. 6,284,376 to Takenouchi et al. (“Takenouchi”), U.S. Patent No. 6,180,263 to Naoi (“Naoi”), U.S. Patent No. 6,087,025 to Dearnaley et al. (“Dearnaley”), and Japanese Patent Publication No. JP 2000-087216 to Kobe Steel (“Kobe”). Finally, claims 6 - 10, 18 - 24 and 27 are rejected under 35 U.S.C. §10b(e) as being anticipated by U.S. Patent No. 6,904,935 to Welty et al. (“Welty”) or U.S. Patent No. 6,740,393 to Massler et al. (“Massler”). As claim 6 is canceled, Applicants submit that the rejections as to claim 6 are thereby moot. Applicants traverse these rejections.

In independent claim 7, Applicants claim:

7. An amorphous carbon film, comprising:

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an amorphous carbon layer; and

an interlayer disposed between a base material and the amorphous carbon layer, said interlayer containing at least one substance selected from the group consisting of B, Al, Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, and W, and said interlayer having a thickness of 0.5 nm or greater 10 nm or less;

wherein on a base material side of said interlayer, there is a mixed layer which contains portions of the base material and the interlayer material and which has a thickness of 0.5 nm or greater and 10 nm or less.

(Emphasis added).

Sumitomo discloses amorphous carbon films for coating tools and the like (see, e.g., abstract of Sumitomo). Sumitomo teaches that it is preferable to provide an interlayer between the base material and the amorphous carbon film for improved adherence (see, e.g., paragraph [0047] of Sumitomo), where the interlayer has a thickness between 0.5 nm and 10 nm (see, e.g., paragraph [0050]). Sumitomo describes a mixed composition or gradient layer inserted between the amorphous carbon layer and the interlayer. In sharp contrast to Applicants' invention as claimed in amended independent claim 7, however, Sumitomo neither teaches nor otherwise suggests that another mixed layer is provided on the base material side of the interlayer.

Takenouchi discloses an ornamental article comprising a base material upon which a hard carbon film is disposed over an intermediate layer (see, e.g., abstract of Takenouchi). Takenouchi indicates that the intermediate layer may contain a transition metal that is present in the base (see, e.g., Col. 2: 52 - 57 of Takenouchi). In sharp contrast to Applicants' claimed invention, however, Takenouchi nowhere teaches or suggests that the intermediate layer include a mixed layer on a base material side of the intermediate layer which contains portions of the

base material and the interlayer material and which has a thickness of 0.5 nm or greater and 10 nm or less.¹

Naoi discloses a hard carbon coating-clad base material comprising a base material, a substrated metal coating, an intermediate metal coating and a hard carbon coating (see, e.g., abstract of Naoi). In sharp contrast to Applicants' claimed invention, however, Naoi nowhere teaches or otherwise suggests that a either of the substrated or intermediate metal coatings includes a mixed layer between the base and the intermediate metal coating that that contains portions of both the base material and the intermediate coating material. Moreover, Naoi fails to disclose or suggest a mixed layer which has a thickness of 0.5 nm or greater and 10 nm or less.²

Dearnaley discloses a diamond-like carbon coating for application to the surfaces of metal cutting tools (see, e.g., abstract of Dearnaley). The coating comprises a base material of a metal alloy, an intermetallic material comprising one or more of silicon and germanium and bonded to metal in said base material; an interlayer comprising one or more of silicon and germanium, and a combination thereof cohesively bonded to an intermetallic material; and carbon chemically bonded to said interlayer (see, e.g., Col. 2: 31 - 47 of Dearnaley). In sharp contrast to Applicants' claimed invention, however, Dearnaley fails to teach or otherwise suggest a mixed layer (i.e., the intermetallic material comprising comprising one or more of silicon and

¹ Takenouchi teaches that a total thickness of the film may be between .15 and 2 μm , which is at least an order of magnitude more than the mixed layer thickness of 0.5 nm or greater and 10 nm or less claimed by Applicants.

² Naoi teaches that a total thickness of the film may be between 0.5 and 5 μm , which is at least an order of magnitude more than the mixed layer thickness of 0.5 nm or greater and 10 nm or less claimed by Applicants.

germanium and bonded to metal in said base material) that has a thickness of 0.5 nm or greater and 10 nm or less.³

Kobe discloses a high adhesion carbon film forming material (see, e.g., abstract of Kobe). An interlayer is formed from components of the base material and the amorphous carbon film. In sharp contrast to Applicant's claimed invention, however, Kobe fails to disclose that the interlayer is formed of an additional metal as enumerated by Applicants' claimed invention (i.e., at least one of B, Al, Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, and W). In addition, Kobe fails to disclose or otherwise suggest Applicants' claimed mixed layer containing portions of the base layer materials and the interlayer materials.

Welty discloses a valve component having multiple surface layers (see, e.g., abstract of Welty). The multi-layer coating disclosed by Welty may include a strengthening layer disposed between a base layer and an amorphous diamond layer (see, e.g., Col. 6: 50 - 52 of Welty). In sharp contrast to Applicants' claimed invention, however, Welty nowhere teaches or suggests that the strengthening layer in addition includes a mixed layer on a base material side of the strengthening layer which contains portions of the base material and the strengthening layer material. Moreover, Welty fails to disclose or suggest a strengthening layer that has a thickness of 0.5 nm or greater and 10 nm or less.⁴

Massler discloses a diamond-like carbon (DLC) coating having an intermediate Si layer and an adjoining a-SiC:H transition zone for improving the adhesion of the DLC coating to the

³ Dearnaley teaches that a total thickness of the film may be in the range of from about 100 to about 200 nm, which is at least an order of magnitude more than the mixed layer thickness of 0.5 nm or greater and 10 nm or less claimed by Applicants.

base (see, e.g., Col. 2: 51 - 64 of Massler). In sharp contrast to Applicant's claimed invention, Massler fails to disclose or suggest that the Si layer is formed of an additional metal as enumerated by Applicants' claimed invention (i.e., at least one of B, Al, Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, and W). Moreover, Massler fails to disclose or otherwise suggest Applicants' claimed mixed layer containing portions of the base layer materials and the interlayer materials.

For at least the above-argued reasons, Applicants submit that none of the cited references anticipate Applicants' amended independent claim 7, and that claim 7 therefore stands in condition for allowance. As each of claims 8 - 10 and 18 - 35 depends either directly or indirectly from allowable claim 7, Applicants further submit that dependent claims 8 - 10 and 18 - 35 are also allowable for at least this reason.

Therefore, Applicants respectfully request that the rejection of claims 7 - 10 and 18 - 35 under 35 U.S.C. §§102(b), (e) be withdrawn.

⁴ Welty teaches that the thickness of the strengthening layer may be between 500 nm to about 6 μ m, which is more than an order of magnitude more than the mixed layer thickness of 0.5 nm or greater and 10 nm or less claimed by Applicants.

CONCLUSION

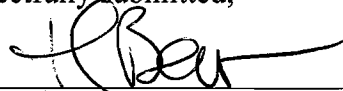
Each and every point raised in the non-final Office Action mailed June 12 2007 has been addressed on the basis of the above amendments and remarks. In view of the foregoing it is believed that claims 6 - 10 and 18 - 35 are in condition for allowance, and it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining which the Examiner believes could be resolved through a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Dated: September 7, 2007

Respectfully submitted,

By



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